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(54) SEPARATOR FOR CAPACITOR AND MANUFACTURING METHOD THEREOF

(57)Abstract:
PROBLEM TO BE SOLVED: To provide a separator for a capacitor having electrolyte solvent resistance, thermal resistance and uniform formation.
SOLUTION: This separator for a capacitor contains fiber (A), that consists of polyamide (a), which is synthesized from a dicarboxylic acid component, containing 60 mol% and more of aromatic dicarboxylic acid and a diamine component, containing 60 mol% and more of aliphatic alkylenediamine.

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CLAIMS

[Claim(s)]
[Claim 1] the aliphatic series alkylene diamine containing the aromatic series dicarboxylic acid beyond 60 mol % of a dicarboxylic acid component and carbon numbers 6-12 -- more than 60 mol % -- the separator for capacitors characterized by including the fiber (A) which consists of a polyamide (a) compounded from the included diamine component.
[Claim 2] The separator for capacitors according to claim 1 whose cross-section flakiness the single fiber fineness of fiber (A) is 0.005 - 0.5dtex, and is 2.0-50.0.
[Claim 3] the aliphatic series alkylene diamine containing the aromatic series dicarboxylic acid beyond 60 mol % of a dicarboxylic acid component and carbon numbers 6-12 -- more than 60 mol % -- the manufacture approach of the separator for capacitors according to claim 1 characterized by milling the polyamide (a) compounded from the included diamine component, and the pulp which contains the assembled-die bicomponent fiber which consists of other thermoplastics 20 to 80%.
[Claim 4] The manufacture approach of the separator for capacitors of claim 3 that thermoplastics is polyester system resin, polyolefine system resin, and polyphenyl sulfide.
[Claim 5] The capacitor which comes to incorporate a separator according to claim 1 or 2.

[Translation done.]

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] Especially this invention relates to the suitable separator for the electric double layer capacitor which uses an organic solvent as the electrolytic solution, and its manufacture approach about the separator for capacitors.
[0002]
[Description of the Prior Art] An electric double layer capacitor has come to be used for the memory backup power supply of a personal computer, the assistance for rechargeable batteries, an alternative, etc. in addition to the applications power-source smoothing which was the main applications of the conventional capacitor (alias name: capacitor), for noise absorption, etc. from having the large capacity for which a nickel cadmium cell, a nickel hydoride battery, and a lithium ion battery are pressed. Although the conventional rechargeable battery has high capacity, while a life is comparatively short and an electric duplex layer capacitor has a comparatively big capacity to rapid charge and discharge having been difficult, it has the good property that long lasting and rapid charge and discharge which are the advantage of capacitor original are possible. Although the main components which constitute an electric duplex layer capacitor are an electrode, the electrolytic solution, a separator, a collecting electrode plate, etc., and the purpose of a separator prevents contact of positive/negative two poles, it is not barring circulation of ion. Since the path of the electrolytic solution becomes long and internal resistance of a separator increases so that the thickness becomes large, to make thickness thin is desired. Although drainage systems (sulfuric-acid water solution etc.) and organic systems (what dissolved tetraethylammonium tetrafluoroborate in propylene carbonate) have been used for the electrolytic solution, an organic system has decomposition voltage higher than the decomposition voltage which carries out the electrolysis of water, and since energy density can be made high, it attracts attention. In order for water to serve as an impurity in an organic system and to reduce the capacitor engine performance, moisture must be removed thoroughly. Therefore, to be made as much as possible at an elevated temperature under a vacuum is desired, and desiccation of a separator also serves as demand physical properties with the important thermal resistance in a desiccation process. Conventionally, although the separator of the cellulose paper used for the capacitor is comparatively excellent in thermal resistance under existence of oxygen, at 150 degrees C, it becomes brown, and heat-resistant improvement is desired. Moreover, naturally the chemically stable thing is demanded of the separator from the electrolytic solution.
[0003]
[Problem(s) to be Solved by the Invention] The purpose of this invention holds the chemical stability to the electrolytic solution, and is to offer the separator for capacitors formed with the nonwoven fabric which uses the polyamide fiber (A) excellent in thermal resistance as a principal component, and its manufacture approach.
[0004]
[Means for Solving the Problem] namely, the aliphatic series alkylene diamine of a dicarboxylic acid component and carbon numbers 6-12 in which this invention contains the aromatic series

dicarboxylic acid beyond [redacted] mol % -- more than 60 mol % -- it is t[redacted]eparator for capacitors characterized by including the fiber (A) which consists of a polyamide (a) compounded from the included diamine component.

[0005]

[Embodiment of the Invention] The polyamide (a) which constitutes the separator for capacitors of this invention consists of a dicarboxylic acid component and a diamine component, and it has the description for more than 60 mol % of a diamine component to be [that more than 60 mol % of a dicarboxylic acid component is aromatic series dicarboxylic acid, and] the aliphatic series alkylene diamine of carbon numbers 6-12.

[0006] As aromatic series dicarboxylic acid, a terephthalic acid is desirable in respect of the thermal resistance of the separator for capacitors, and electrolytic-solution-proof nature. Isophthalic acid, 2, 6-naphthalene dicarboxylic acid, 2, 7-naphthalene dicarboxylic acid, 1, 4-naphthalene dicarboxylic acid, 1, 4-phenylene dioxy diacetate, A 1,3-phenylenedioxy diacetate, diphenic acid, JI benzoic-acid, 4, and 4'-OKISHIJI benzoic acid, One or more kinds of aromatic series dicarboxylic acid, such as diphenylmethane -4, 4'-dicarboxylic acid, diphenylsulfone -4, and - dicarboxylic acid, and 4 '4, 4'-biphenyl dicarboxylic acid, can also be used, using it together. The content of this aromatic series dicarboxylic acid is more than 60 mol % of a dicarboxylic acid component, and it is desirable that it is more than 75 mol %. As dicarboxylic acid other than the above-mentioned aromatic series dicarboxylic acid, alicyclic dicarboxylic acid, such as aliphatic series dicarboxylic acid;1, such as malonic-acid, dimethyl malonic-acid, succinic-acid, 3, and 3-diethyl succinic-acid, glutaric-acid, 2, and 2-dimethyl glutaric-acid, adipic-acid, 2-methyl adipic-acid, trimethyl adipic-acid, pimelic-acid, azelaic-acid, sebacic-acid, and suberic acid, 3-cyclopentane dicarboxylic acid, 1, and 4-cyclohexane dicarboxylic acid, can be mentioned, and two or more kinds of these acids can be used only not only in one kind. It is desirable that a dicarboxylic acid component is 100% aromatic series dicarboxylic acid especially in respect of the reinforcement of a nonwoven fabric, electrolytic-solution-proof nature, thermal resistance, etc. Multiple-valued carboxylic acids, such as trimellitic acid, trimesic acid, and pyromellitic acid, can also be made to contain within limits with easy fibrosis and nonwoven-fabric-izing furthermore.

[0007] A carbon number consists of alkylene diamines of 6-12 more than 60 mol % of a diamine component. Moreover, as this aliphatic series alkylene diamine 1, 6-hexanediamine, 1, 8-octane diamine, 1, 9-nonane diamine, 1, 10-Deccan diamine, 1, and 11-undecane diamine, 1, 12-dodecane diamine, The 2-methyl -1, 5-pentane diamine, the 3-methyl -1, 5-pentane diamine, 2, 2, 4-trimethyl -1, 6-hexanediamine, 2 and 4, 4-trimethyl -The aliphatic series diamine which has a straight chain or side chains, such as 1, 6-hexanediamine, the 2-methyl -1, 8-octane diamine, the 5-methyl -1, and 9-nonane diamine, can be mentioned. Concomitant use with 1, 9-nonane diamine, 1, and 9-nonane diamine, and the 2-methyl -1 and 8-octane diamine is desirable in respect of electrolytic-solution-proof nature especially. Although the content of this aliphatic series alkylene diamine is more than 60 mol % of a diamine component, it is especially desirable more than 75 mol % and that it is more than 90 mol % in respect of thermal resistance.

[0008] As diamines other than above-mentioned aliphatic series alkylene diamine, ethylenediamine, Aliphatic series diamines, such as 1,4-butanediamine; A cyclohexanediamine, Methylcyclohexane diamine, isophorone diamine, norbornane dimethyl diamine, Alicyclic diamines, such as tricyclodecane dimethyl diamine; P-phenylene diamine, m-phenylenediamine, xylylene diamine, xylene diamine, 4 and 4' -- aromatic series diamines, such as - diaminodiphenyl sulfone, and - diamino diphenylmethane, 4, and 4 '4, 4'-diamino diphenyl ether, or such mixture can be mentioned, it does not become impossible to see these to one kind, but they can use two or more kinds.

[0009] When using together 1 and 9-nonane diamine, and the 2-methyl -1 and 8-octane diamine as aliphatic series alkylene diamine, 60-100-mol% of a diamine component consists of 1 and 9-nonane diamine, and the 2-methyl -1 and 8-octane diamine, and, as for the mole ratio, it is especially desirable former:latter =30:70-99:1 and that it is former:latter =40:60-95:5.

[0010] Moreover, 1 / 2 - 1/8, and that it is especially 1 / 3 - 1/5 have [the polyamide used for this invention] the desirable ratio of [CONH/CH2] in the chain. The separator for capacitors

excellent in electrolytic-[redacted]tion-proof nature and thermal resista[redacted]is obtained by using the polyamide of this range.

[0011] As for the limiting viscosity (value measured by 30 degrees C of concentrated sulfuric acid) of an above-mentioned polyamide, it is desirable that it is 0.6 - 2.0 dl/g, and 0.6 - 1.8 dl/g and its 0.7 - 1.6 dl/g are especially desirable. The polyamide of this limiting viscosity within the limits has fibrosis and a good melt viscosity property at the time of nonwoven-fabric-izing, and becomes the thing excellent in the reinforcement of the separator obtained further, electrolytic-solution-proof nature, and thermal resistance.

[0012] As for a further above-mentioned polyamide, it is desirable that the closure of the 10% or more of the end group of the chain is carried out with end encapsulant, and its thing of an end further done for the closure of the 70% or more of an end is desirable 40% or more. By closing the end of a chain, it becomes the thing excellent in the reinforcement of the separator obtained, electrolytic-solution-proof nature, thermal resistance, etc. Although there will be especially no limit if it is the compound of the monofunctional nature which has the amino group of a polyamide end or a carboxyl group, and reactivity as end encapsulant, monocarboxylic acid and monoamine are desirable from points, such as reactivity and the stability of a closure end. Monocarboxylic acid is desirable in respect of the ease of handling, reactivity, the stability of a closure end, and a price. As monocarboxylic acid, an acetic acid, a propionic acid, butanoic acid, a valeric acid, a caproic acid, a caprylic acid, a lauric acid, a tridecyl acid, a myristic acid, a palmitic acid, stearin acid, a benzoic acid, etc. can be mentioned. In addition, it can ask for the rate of the closure of an end from the integral value of the property signal corresponding to each end group by 1 H-NMR.

[0013] Especially the manufacture approach of the polyamide used by this invention is not limited, but can use the approach of the arbitration well-known as an approach which manufactures a crystalline polyamide. For example, it can manufacture by the approaches of using as a raw material the alkyl ester and diamine of the solution polymerization method which uses acid chloride and diamine as a raw material or interfacial polymerization, dicarboxylic acid, or dicarboxylic acid, such as a melting polymerization method and a solid-state-polymerization method.

[0014] If an example is given, after putting in block end encapsulant, a catalyst, a diamine component, and a dicarboxylic acid component, making them react and manufacturing nylon salt, it can manufacture easily by limiting viscosity's once considering as the prepolymer of 0.15 - 0.30 dl/g in the temperature of 280 degrees C or less, and carrying out solid state polymerization further, or performing a polymerization using a melting extruder. When solid state polymerization performs the culmination of a polymerization, if it is the range whose polymerization temperature is 200-250 degrees C, a rate of polymerization is large, and since it excels in productivity and coloring and gelation can be controlled effectively, it is desirable [it is desirable to carry out to the bottom of reduced pressure or inert gas circulation, and]. When a melting extruder performs the culmination of a polymerization, since there is almost no decomposition of a polyamide that polymerization temperature is 370 degrees C or less and a polyamide with little degradation is obtained, it is desirable.

[0015] As a polymerization catalyst, a phosphoric acid, phosphorous acid, hypophosphorous acid or those ammonium salt, those metal salts, and those ester can be mentioned, and sodium hypophosphite is desirable in respect of handling nature in the ease of carrying out of acquisition especially. Moreover, stabilizers, such as a copper compound, a coloring agent, an ultraviolet ray absorbent, light stabilizer, an antioxidant, an antistatic agent, a flame retarder, a plasticizer, lubricant, a crystallization rate retarder, etc. can be added polycondensation reaction time or after that if needed. If alkali halide metallic compounds, such as halogenation copper compounds, such as organic system stabilizers, such as a hindered phenol, and copper iodide, and potassium iodide, are added especially as a thermostabilizer, since the thermal resistance in the case of the melting stagnation stability in the case of fibrosis improving, and using as a separator will improve, it is desirable.

[0016] Manufacture of the fiber (A) using the polyamide (a) of this invention can use well-known melt spinning equipment. What is necessary is to carry out melting kneading of a polyamide (a)

and other thermoplastic [redacted]mers with a respectively different ex[redacted]r, and just to make it breathe out from the same spinning nozzle succeedingly, although you may fibrose by which approach of independent spinning and compound spinning for example, if it is compound spinning. In this case, what mixed a polyamide (a) and two or more polymers beforehand may be used for one of the compound components.

[0017] Although a direct-spinning method, a sea island method, and a division method are held as an approach of obtaining the super-thin polyamide fiber (A) of 0.5 or less dtex of single fiber fineness, a division method is desirable in order to obtain the super-thin fiber of a flattened section configuration. Although the assembled-die bicomponent fiber may be constituted by three or more sorts of components, from points, such as spinning nature and division nature, it is desirable that it is two-component system fiber. When using this polyamide (a) as one component, the fiber for which the polyamide (a) is divided especially into the field of 8-200 two or more with other thermoplastic polymers on the fiber cross section is desirable. Moreover, the fiber for which the polyamide (a) is following the direction substantially in fiber length is desirable. More specifically, bicomponent fibers, such as a multilayer-like assembled die and a radial assembled die, as shown in (1) - (6) of drawing 1 can use it suitably.

[0018] As for the fineness (fiber fineness after division when divided) of the fiber (A) which constitutes a separator, it is desirable that it is 0.005 - 0.5dtex from the point of lamellation, formation, and separate nature. Moreover, as for the fiber cross section, it is desirable that whenever [cross-section / which is expressed with the ratio (DI/Ds) of a major axis and a minor axis / flat] are 2.0-50.0. It is 2.0-25.0 more preferably and the thing of 2.2-15.0 is used suitably still more preferably. When fineness is less than 0.005 dtexes, sheet-ization may become difficult and the endurance of a separator may fall remarkably. Moreover, when exceeding 0.5dtex, and lamellation of the separator is carried out, formation gets worse remarkably. Even if it is a sheet 100 micrometers or less by making the fiber in a textile into this fineness and a flattened section configuration, formation can be equalized, while pore size becomes small and being able to improve separate nature further. Moreover, although especially fiber length is not limited and it can set up suitably by the formation approach of a separator, in order to obtain a thin and uniform nonwoven fabric, it is desirable to form a nonwoven fabric by the wet milling-paper method, and it is desirable that it is 1-30mm in this case. About a fiber cross section, when whenever [cross-section / which is expressed with the ratio (DI/Ds) of a major axis and a minor axis / flat] is less than 2.0, aggravation of the formation of the sheet by the lamellation of a separator becomes large, and it is hard to demonstrate the description. Moreover, when whenever [cross-section flat] exceeds 50, it may be difficult to obtain the fiber of a stable cross-section configuration. In addition, in this invention, in the case of the multilayer mold assembled-die bicomponent fiber of drawing 1 as shown in (1), as the major axis D1 of a flat fiber cross section and a minor axis Ds are shown in drawing 2 , they ask it.

[0019] Especially as other thermoplastic polymers, although not limited, since an assembled-die bicomponent fiber is ******-ized with mechanical stress, such as shearing force, polyester system resin, olefin system resin, polyphenylene sulfide, etc. can use it suitably. When these resin is used, since compatibility with a polyamide (a) is scarce, fiber excellent in division nature is obtained. In this case, the fiber substantially divided completely by the disaggregation force by the pulper and mixer at the time of wet paper milling is obtained. For this reason, it is not necessary to perform high-pressure stream interlacement for ******-izing, the pinhole by stream interlaced marks is not generated, and since the fiber which carried out full division substantially can be milled, there is an advantage that the sheet of uniform formation is obtained compared with the wet sheet with which fiber was ******-ized by processing after paper milling of pressurization etc. The separator excellent in electrolytic-solution-proof nature and thermal resistance is obtained by using the resin of polyethylene terephthalate, aromatic polyester, the poly methyl pentene, and polyphenylene sulfide especially.

[0020] Moreover, in this invention, other fiber may be blended in addition to a polyamide fiber (A), and a separator may be obtained. For example, polyethylene terephthalate, polybutylene terephthalate, Polyester systems, such as all aromatic polyester, polyphenylene sulfide, Aliphatic series polyamides, such as nylon 6 and Nylon 66; An ethylene-vinyl alcohol system copolymer,

Polypropylene, polyethyl[redacted]polybutene, the poly methyl pentene[redacted] cellulosic fiber which mercerized the fiber; natural cellulose fiber of the compound gestalt which consists of polyolefine system resin independent, such as ethylene propylene rubber and an ethylene-butene copolymer, or two kinds or more; The pulp by which marcerization was carried out, The fiber which consists of a polyamide (a) from which fineness differs can be mentioned. Moreover, it is also possible by using a well-known thermofusion nature binder especially binder fiber, a sizing agent, etc. to raise the gestalt stability of a nonwoven fabric. As for the single fiber fineness of these fiber, it is desirable that it is 0.01 - 3dtex from points, such as lamellation, formation, separate nature, and strength, and it is desirable from electrolytic-solution-proof nature and a heat-resistant point to blend the independent fiber of a polyester system, a polyolefin fiber, polyphenylene sulfide, or a polyamide (a). Especially the fiber cross section is not limited [mold / a round shape, a cocoon type, a hollow mold, / T]. In order to raise separator powerful, gestalt stability, etc. furthermore, a binder, especially binder fiber may be blended further. The above-mentioned effectiveness is acquired without raising internal resistance beyond the need, when a fibrous binder is blended. As for the fineness of binder fiber, from points, such as separator strength, homogeneity, and production process nature, it is desirable that it is 0.5 - 6dtex extent. In addition, after nonwoven-fabric-izing a fibrous binder, it is not necessary to hold the configuration of fiber clearly, and the above-mentioned effectiveness is acquired by manufacturing a nonwoven fabric using a fibrous binder.

[0021] Although binder fiber may be constituted by the single component, since sufficient strength can be held while doing the adhesion effectiveness so, being constituted by two or more components is desirable. Bicomponent fibers and sea island fiber, such as a sheath-core mold, side-by-side mold, stratified assembled-die, and radial assembled die, can use it suitably. Especially the fiber cross section is not limited [mold / a round shape, flat, a cocoon type, a hollow mold, / T].

[0022] Thus, remarkable effectiveness is acquired in respect of electrolytic-solution-proof nature, thermal resistance, etc. by fibrosing and using the polyamide (a) obtained as a member for separators. On the occasion of manufacture of the separator for capacitors, it can be made sheets, such as woven knitted goods, a dry type nonwoven fabric, and a wet nonwoven fabric, that what is necessary is just to sheet-ize using this fiber. Moreover, it is also possible to sheet-ize immediately after fibrosis by the melt BURON method or the span bond method. Especially sheet-izing by wet paper milling from the point that a sheet thin and uniform [desirable / that it is a nonwoven fabric / and] is obtained from points, such as separate nature and mechanical engine performance, is desirable. For the manifestation of improvement in surface smooth nature, thickness adjustment of a sheet, reinforcement, and densification, it is desirable after sheet-izing to perform heat calender processing.

[0023] The separator of this invention can also obtain the separator of internal resistance low with a thin shape, and uniform formation by using the polyamide fiber (A) of a flattened section configuration as a member for separators. Specifically, it is possible to set thickness to 100 micrometers or less. Internal resistance can be lowered by using the thin separator using the polyamide fiber (A) of this invention. When the mechanical strength as a nonwoven fabric is taken into consideration, 50 micrometers or more are desirable, and in order to thin-shape-ize and to raise the energy density of a capacitor, it is desirable that it is 100 micrometers or less. As for a basis weight, it is desirable that they are about two 20 - 60 g/m, and a consistency 0.1 - about three 0.6 g/cm.

[0024] It can consider as the separator for capacitors by processing the configuration of requests, such as a bag-like object and a spiral object, using this sheet for separators for capacitors as it is. Of course, the separator for capacitors may be manufactured combining things other than this sheet. For example, a laminating can be carried out to other sheets (a nonwoven fabric, film, etc.), or it can join together. However, from the point of acquiring the effectiveness of this invention efficiently, it is desirable to manufacture the separator for capacitors only from the above-mentioned sheet, especially a nonwoven fabric substantially. The capacitor excellent in many engine performance is obtained by incorporating the separator for capacitors of this invention.

[0025] Such a separator for capacitors can be used not only for the separator for capacitors but for a battery separator, a filter, a wiper, a packing material, etc.
[0026]
[Example] Although an example explains this invention below, it is not limited at all by this example. In addition, each measured value in an example is a value measured by the following approaches.
[Thickness (mm)] JIS P It measured according to 8118 "the thickness of paper and the paper board, and the test method of a consistency."
[Basis weight (g/m2)] JIS P It measured according to 8124 "the meter basis-weight measuring method of paper."
[Reinforcement (kg / 15mm)] JIS P It measured according to 8113 "the tensile strength test method of paper and the paper board."
[Permeability (cm3/cm2/sec)] JIS L According to the permeability measuring method of 1096-1996 "a common textiles test method", it measured with the incorporated company Oriental energy machine factory Flagyl mold permeability test machine.
[electrolytic-solution-proof nature (%)] JIS P 8113 -- applying correspondingly -- the test piece before and behind electrolytic-solution-proof nature processing -- being powerful (N/15mm) -- it measured and expressed with the powerful retention. Processing carried out immersion processing of the test piece of a nonwoven fabric under nitrogen-gas-atmosphere mind for 1 hour at the 50-degree C polycarbonate (Wako Pure Chem, Inc. make).
While a thermogravimetric measurement machine (physical science: TAS-200) investigates the weight percentage reduction (%) of the separator held at 150 degrees C and 200 degrees C in the [heat-resistant (%)] nitrogen air current for 1 hour, it is visual observation about gestalt change.
[0027] [The example 1 of reference]
19.5 mols of [manufacture of polyamide (a) which uses 1 and 9-nonane diamine, and 2-methyl -1 and 8-octane diamine as diamine component, and uses terephthalic acid as dicarboxylic acid component] terephthalic acids, 1, 10.0 mols of 9-nonane diamines, the 2-methyl -1, 10.0 mols of 8-octane diamines, 1.0 mols of benzoic acids, 0.06 mols of sodium hypophosphite-hydrates, and 2.2l. of distilled water were added to the autoclave of 20l. of content volume, and the nitrogen purge be performed Subsequently, it stirred for 30 minutes at 100 degrees C, and the temperature up of the inside ** was carried out to 210 degrees C over 2 hours. At this time, the pressure up of the autoclave was carried out to 2.2MPa(s). After continuing a reaction then for 1 hour, the temperature up was carried out to 230 degrees C, and it kept at 230 degrees C after that for 2 hours, and the reaction was continued, having extracted the steam gradually and holding a pressure to 2.2MPa(s). Next, the prepolymer was obtained for the reaction continuously [the pressure was lowered to 1.0MPa(s) over 30 minutes, and / for further 1 hour]. Under 100 degrees C and reduced pressure, it dried for 12 hours and this prepolymer was ground to the magnitude of 2mm or less. The polymer was obtained by carrying out solid state polymerization of this grinding object under 230 degrees C and 10Pa for 10 hours. The limiting viscosity of the obtained polymer was 0.9 dl/g.
[0028] Melting extrusion of the polyamide (a) manufactured in the example 1 of [example 1] reference was carried out using the extruder, from the nozzle with a bore diameter of 0.15mm, it rolled round by part for 1,000m/in discharge and winding rate, and non-extended yarn was obtained. Subsequently, non-extended yarn was extended using the water bath with a water bath temperature of 90 degrees C, and the tow of fineness 1.5dtex was obtained. The obtained tow was cut to 5mm of cut length, and it considered as the shortcut of (Polyamide a) independent fiber. Paper making of this shortcut was carried out with the hand papermaking paper machine (square shape 25cmx25cm), the wet nonwoven fabric of basis-weight about 40 g/m2 was created, subsequently the heat press was carried out in the embossing calender (embossing roll temperature of 240 degrees C, linear pressure 40 kg/cm), and the separator for capacitors was obtained. The obtained separator had homogeneity and electrolytic-solution-proof nature, thermal resistance, and a high mechanical property, and it was what has the engine performance which was excellent as a separator for capacitors. The engine performance is shown in Table 1.

[0029] The polyamide (a[redacted]tained in the example 1 of [example 2[redacted]erence 67 mass % (X zone), The polyethylene terephthalate of intrinsic viscosity 0.68 (it measures at 30 degrees C with the of-the-same-quality amount mixed solvent of a phenol/tetrachloroethane) is compounded with the compounding ratio of 33 mass %. Melting extrusion was carried out with the extruder and Y layers of X zone as shown in (1) of discharge and drawing 1 from the round hole nozzle of 0.25mmphi manufactured the elliptical multilayer mold assembled-die bicomponent fiber which comes to carry out a laminating by turns. X zone is [six layers and Y layers of the number of the layers of this assembled-die bicomponent fiber] a total of 11 five-layer layers. Subsequently, it extended using the water bath with a water bath temperature of 90 degrees C, and the tow of fineness 3.0dtex was obtained. The obtained tow was cut to 5mm of cut length, and it was made the shortcut of the assembled-die bicomponent fiber which consists of a polyamide (a) and polyester. The cross-section oblateness (DI/Ds) after division of an assembled-die bicomponent fiber was 2.4-7.5. Moreover, the polyethylene terephthalate of intrinsic viscosity 0.55 was fibrosed like the example 1, non-extended yarn was obtained, and it was made the shortcut of 5mm cut. Paper making of shortcut 70 mass [of the assembled-die bicomponent fiber which consists of this polyamide (a) and polyester] %, and the shortcut 30 mass % which consists of non-extended yarn of polyester was carried out with the hand papermaking paper machine (square shape 25cmx25cm), the basis weight of about 40g/the wet nonwoven fabric of m2 was created, subsequently the heat press was carried out in the calender (roll temperature of 230 degrees C, linear pressure 40 kg/cm), and the separator for capacitors was obtained. The obtained separator had homogeneity and electrolytic-solution-proof nature, thermal resistance, and a high mechanical property, and it was what has the engine performance which was excellent as a separator for capacitors. The engine performance is shown in Table 1.

[0030] The shortcut of an assembled-die bicomponent fiber was obtained like the example 2 except having used the poly methyl pentene (Mitsui Chemicals, DX820) instead of the polyethylene terephthalate of [example 3] intrinsic viscosity 0.68. Moreover, the shortcut of the non-extended yarn of a polyamide (a) was obtained like the example 2 except having used the polyamide (a) of intrinsic viscosity 0.65 instead of the polyethylene terephthalate of intrinsic viscosity 0.55. Paper making of these was carried out like the example 2, calender processing was carried out and the separator was obtained. The obtained separator had homogeneity and electrolytic-solution-proof nature, thermal resistance, and a high mechanical property, and it was what has the engine performance which was excellent as a separator for capacitors. The engine performance is shown in Table 1.

[0031] The separator was obtained like the example 3 except using polyphenylene sulfide (Toray Industries, Inc.: FO TRON E2481) instead of using a [example 4] poly methyl pentene. The obtained separator had homogeneity and electrolytic-solution-proof nature, thermal resistance, and a high mechanical property, and it was what has the engine performance which was excellent as a separator for capacitors. The engine performance is shown in Table 1.

[0032] The shortcut of an assembled-die bicomponent fiber was obtained like the example 3 except using polypropylene (Japan Polychem, SD2) instead of using a [example 5] poly methyl pentene. Paper making of shortcut 80 mass % of this assembled-die bicomponent fiber and the (Polyamide a) extension yarn shortcut 20 mass % of an example 1 was carried out like the example 3, calender processing was carried out at 170 degrees C, and the separator was obtained. It was that in which the polypropylene component of an assembled-die bicomponent fiber serves as a binder, and the obtained separator has the engine performance which homogeneity and electrolytic-solution-proof nature, thermal resistance (however, polypropylene fused and the gestalt was changing a lot at 200 degrees C), and whose mechanical property were high, and was excellent as a separator for capacitors. The engine performance is shown in Table 1.

[0033] In the [example 1 of comparison] example 1, fibrosis and the separator which carries out paper making, carries out embossing processing at 100 degrees C, and consists of polyethylene were obtained like the example 1 instead of the polyamide (a) except having used polyethylene (Japan Polychem, HE483). Although the obtained separator was excellent in homogeneity and electrolytic-solution-proof nature, thermal resistance (at 150 degrees C, polyethylene fuses and

a gestalt changes a lot) [redacted] mechanical property were low. The [redacted]e performance is shown in Table 1.

[0034]

[Table 1]

	厚さ μm	坪量 g/m²	強度 N/15mm	透気度 cm³/cm²/sec	耐電解液性 %	耐熱性 150℃ %	耐熱性 200℃ %
実施例1	136	40.1	18.6	4.9	99	0.1	0.1
実施例2	98	40.2	27.9	3.8	99	0.1	0.1
実施例3	92	39.9	28.3	3.6	99	0.1	0.1
実施例4	96	40.1	29.5	3.7	99	0.1	0.1
実施例5	89	39.8	30.1	3.1	99	0.2	—
比較例1	122	38.9	11.3	4.6	99	—	—

[0035]

[Effect of the Invention] By this invention, it excels in the electrolytic solution-proof and thermal resistance, and the uniform separator for capacitors of conditions can be offered.

[Translation done.]

TECHNICAL FIELD

[Field of the Invention] Especially this invention relates to the suitable separator for the electric double layer capacitor which uses an organic solvent as the electrolytic solution, and its manufacture approach about the separator for capacitors.

[Translation done.]

PRIOR ART

[Description of the Prior Art] An electric double layer capacitor has come to be used for the memory backup power supply of a personal computer, the assistance for rechargeable batteries, an alternative, etc. in addition to the applications power-source smoothing which was the main applications of the conventional capacitor (alias name: capacitor), for noise absorption, etc. from having the large capacity for which a nickel cadmium cell, a nickel hydoride battery, and a lithium ion battery are pressed. Although the conventional rechargeable battery has high capacity, while a life is comparatively short and an electric duplex layer capacitor has a comparatively big capacity to rapid charge and discharge having been difficult, it has the good property that long lasting and rapid charge and discharge which are the advantage of capacitor original are possible. Although the main components which constitute an electric duplex layer capacitor are an electrode, the electrolytic solution, a separator, a collecting electrode plate, etc., and the purpose of a separator prevents contact of positive/negative two poles, it is not barring circulation of ion. Since the path of the electrolytic solution becomes long and internal resistance of a separator increases so that the thickness becomes large, to make thickness thin is desired. Although drainage systems (sulfuric-acid water solution etc.) and organic systems (what dissolved tetraethylammonium tetrafluoroborate in propylene carbonate) have been used for the electrolytic solution, an organic system has decomposition voltage higher than the decomposition voltage which carries out the electrolysis of water, and since energy density can be made high, it attracts attention. In order for water to serve as an impurity in an organic system and to reduce the capacitor engine performance, moisture must be removed thoroughly. Therefore, to be made as much as possible at an elevated temperature under a vacuum is desired, and desiccation of a separator also serves as demand physical properties with the important thermal resistance in a desiccation process. Conventionally, although the separator of the cellulose paper used for the capacitor is comparatively excellent in thermal resistance under existence of oxygen, at 150 degrees C, it becomes brown, and heat-resistant improvement is desired. Moreover, naturally the chemically stable thing is demanded of the separator from the electrolytic solution.

[Translation done.]

EFFECT OF THE INVENTION

[Effect of the Invention] By this invention, it excels in the electrolytic solution-proof and thermal resistance, and the uniform separator for capacitors of conditions can be offered.

[Translation done.]

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention] The purpose of this invention holds the chemical stability to the electrolytic solution, and is to offer the separator for capacitors formed with the nonwoven fabric which uses the polyamide fiber (A) excellent in thermal resistance as a principal component, and its manufacture approach.

[Translation done.]

MEANS

[Means for Solving the Problem] namely, the aliphatic series alkylene diamine of a dicarboxylic acid component and carbon numbers 6-12 in which this invention contains the aromatic series dicarboxylic acid beyond 60 mol % -- more than 60 mol % -- it is the separator for capacitors characterized by including the fiber (A) which consists of a polyamide (a) compounded from the included diamine component.
[0005]
[Embodiment of the Invention] The polyamide (a) which constitutes the separator for capacitors of this invention consists of a dicarboxylic acid component and a diamine component, and it has the description for more than 60 mol % of a diamine component to be [that more than 60 mol % of a dicarboxylic acid component is aromatic series dicarboxylic acid, and] the aliphatic series alkylene diamine of carbon numbers 6-12.
[0006] As aromatic series dicarboxylic acid, a terephthalic acid is desirable in respect of the thermal resistance of the separator for capacitors, and electrolytic-solution-proof nature. Isophthalic acid, 2, 6-naphthalene dicarboxylic acid, 2, 7-naphthalene dicarboxylic acid, 1, 4-naphthalene dicarboxylic acid, 1, 4-phenylene dioxy diacetate, A 1,3-phenylenedioxy diacetate, diphenic acid, JI benzoic-acid, 4, and 4'-OKISHIJI benzoic acid, One or more kinds of aromatic series dicarboxylic acid, such as diphenylmethane -4, 4'-dicarboxylic acid, diphenylsulfone -4, and - dicarboxylic acid, and 4 '4, 4'-biphenyl dicarboxylic acid, can also be used, using it together. The content of this aromatic series dicarboxylic acid is more than 60 mol % of a dicarboxylic acid component, and it is desirable that it is more than 75 mol %. As dicarboxylic acid other than the above-mentioned aromatic series dicarboxylic acid, alicyclic dicarboxylic acid, such as aliphatic series dicarboxylic acid;1, such as malonic-acid, dimethyl malonic-acid, succinic-acid, 3, and 3-diethyl succinic-acid, glutaric-acid, 2, and 2-dimethyl glutaric-acid, adipic-acid, 2-methyl adipic-acid, trimethyl adipic-acid, pimelic-acid, azelaic-acid, sebacic-acid, and suberic acid, 3-cyclopentane dicarboxylic acid, 1, and 4-cyclohexane dicarboxylic acid, can be mentioned, and two or more kinds of these acids can be used only not only in one kind. It is desirable that a dicarboxylic acid component is 100% aromatic series dicarboxylic acid especially in respect of the reinforcement of a nonwoven fabric, electrolytic-solution-proof nature, thermal resistance, etc. Multiple-valued carboxylic acids, such as trimellitic acid, trimesic acid, and pyromellitic acid, can also be made to contain within limits with easy fibrosis and nonwoven-fabric-izing furthermore.
[0007] A carbon number consists of alkylene diamines of 6-12 more than 60 mol % of a diamine component. Moreover, as this aliphatic series alkylene diamine 1, 6-hexanediamine, 1, 8-octane diamine, 1, 9-nonane diamine, 1, 10-Deccan diamine, 1, and 11-undecane diamine, 1, 12-dodecane diamine, The 2-methyl -1, 5-pentane diamine, the 3-methyl -1, 5-pentane diamine, 2, 2, 4-trimethyl -1, 6-hexanediamine, 2 and 4, 4-trimethyl -The aliphatic series diamine which has a straight chain or side chains, such as 1, 6-hexanediamine, the 2-methyl -1, 8-octane diamine, the 5-methyl -1, and 9-nonane diamine, can be mentioned. Concomitant use with 1, 9-nonane diamine, 1, and 9-nonane diamine, and the 2-methyl -1 and 8-octane diamine is desirable in respect of electrolytic-solution-proof nature especially. Although the content of this aliphatic series alkylene diamine is more than 60 mol % of a diamine component, it is especially desirable

more than 75 mol % and [redacted]it is more than 90 mol % in respect of [redacted]rmal resistance.
[0008] As diamines other than above-mentioned aliphatic series alkylene diamine, ethylenediamine, Aliphatic series diamines, such as 1,4-butanediamine; A cyclohexanediamine, Methylcyclohexane diamine, isophorone diamine, norbornane dimethyl diamine, Alicyclic diamines, such as tricyclodecane dimethyl diamine; P-phenylene diamine, m-phenylenediamine, xylylene diamine, xylene diamine, 4 and 4' -- aromatic series diamines, such as - diaminodiphenyl sulfone, and - diamino diphenylmethane, 4, and 4 '4, 4'-diamino diphenyl ether, or such mixture can be mentioned, it does not become impossible to see these to one kind, but they can use two or more kinds.
[0009] When using together 1 and 9-nonane diamine, and the 2-methyl -1 and 8-octane diamine as aliphatic series alkylene diamine, 60-100-mol% of a diamine component consists of 1 and 9-nonane diamine, and the 2-methyl -1 and 8-octane diamine, and, as for the mole ratio, it is especially desirable former:latter =30:70-99:1 and that it is former:latter =40:60-95:5.
[0010] Moreover, 1 / 2 - 1/8, and that it is especially 1 / 3 - 1/5 have [the polyamide used for this invention] the desirable ratio of [CONH/CH2] in the chain. The separator for capacitors excellent in electrolytic-solution-proof nature and thermal resistance is obtained by using the polyamide of this range.
[0011] As for the limiting viscosity (value measured by 30 degrees C of concentrated sulfuric acid) of an above-mentioned polyamide, it is desirable that it is 0.6 - 2.0 dl/g, and 0.6 - 1.8 dl/g and its 0.7 - 1.6 dl/g are especially desirable. The polyamide of this limiting viscosity within the limits has fibrosis and a good melt viscosity property at the time of nonwoven-fabric-izing, and becomes the thing excellent in the reinforcement of the separator obtained further, electrolytic-solution-proof nature, and thermal resistance.
[0012] As for a further above-mentioned polyamide, it is desirable that the closure of the 10% or more of the end group of the chain is carried out with end encapsulant, and its thing of an end further done for the closure of the 70% or more of an end is desirable 40% or more. By closing the end of a chain, it becomes the thing excellent in the reinforcement of the separator obtained, electrolytic-solution-proof nature, thermal resistance, etc. Although there will be especially no limit if it is the compound of the monofunctional nature which has the amino group of a polyamide end or a carboxyl group, and reactivity as end encapsulant, monocarboxylic acid and monoamine are desirable from points, such as reactivity and the stability of a closure end. Monocarboxylic acid is desirable in respect of the ease of handling, reactivity, the stability of a closure end, and a price. As monocarboxylic acid, an acetic acid, a propionic acid, butanoic acid, a valeric acid, a caproic acid, a caprylic acid, a lauric acid, a tridecyl acid, a myristic acid, a palmitic acid, stearin acid, a benzoic acid, etc. can be mentioned. In addition, it can ask for the rate of the closure of an end from the integral value of the property signal corresponding to each end group by 1 H-NMR.
[0013] Especially the manufacture approach of the polyamide used by this invention is not limited, but can use the approach of the arbitration well-known as an approach which manufactures a crystalline polyamide. For example, it can manufacture by the approaches of using as a raw material the alkyl ester and diamine of the solution polymerization method which uses acid chloride and diamine as a raw material or interfacial polymerization, dicarboxylic acid, or dicarboxylic acid, such as a melting polymerization method and a solid-state-polymerization method.
[0014] If an example is given, after putting in block end encapsulant, a catalyst, a diamine component, and a dicarboxylic acid component, making them react and manufacturing nylon salt, it can manufacture easily by limiting viscosity's once considering as the prepolymer of 0.15 - 0.30 dl/g in the temperature of 280 degrees C or less, and carrying out solid state polymerization further, or performing a polymerization using a melting extruder. When solid state polymerization performs the culmination of a polymerization, if it is the range whose polymerization temperature is 200-250 degrees C, a rate of polymerization is large, and since it excels in productivity and coloring and gelation can be controlled effectively, it is desirable [it is desirable to carry out to the bottom of reduced pressure or inert gas circulation, and]. When a melting extruder performs the culmination of a polymerization, since there is almost no decomposition of a polyamide that

polymerization temperat[redacted]s 370 degrees C or less and a polyam[redacted]with little degradation is obtained, it is desirable.

[0015] As a polymerization catalyst, a phosphoric acid, phosphorous acid, hypophosphorous acid or those ammonium salt, those metal salts, and those ester can be mentioned, and sodium hypophosphite is desirable in respect of handling nature in the ease of carrying out of acquisition especially. Moreover, stabilizers, such as a copper compound, a coloring agent, an ultraviolet ray absorbent, light stabilizer, an antioxidant, an antistatic agent, a flame retarder, a plasticizer, lubricant, a crystallization rate retarder, etc. can be added polycondensation reaction time or after that if needed. If alkali halide metallic compounds, such as halogenation copper compounds, such as organic system stabilizers, such as a hindered phenol, and copper iodide, and potassium iodide, are added especially as a thermostabilizer, since the thermal resistance in the case of the melting stagnation stability in the case of fibrosis improving, and using as a separator will improve, it is desirable.

[0016] Manufacture of the fiber (A) using the polyamide (a) of this invention can use well-known melt spinning equipment. What is necessary is to carry out melting kneading of a polyamide (a) and other thermoplastic polymers with a respectively different extruder, and just to make it breathe out from the same spinning nozzle succeedingly, although you may fibrose by which approach of independent spinning and compound spinning for example, if it is compound spinning. In this case, what mixed a polyamide (a) and two or more polymers beforehand may be used for one of the compound components.

[0017] Although a direct-spinning method, a sea island method, and a division method are held as an approach of obtaining the super-thin polyamide fiber (A) of 0.5 or less dtex of single fiber fineness, a division method is desirable in order to obtain the super-thin fiber of a flattened section configuration. Although the assembled-die bicomponent fiber may be constituted by three or more sorts of components, from points, such as spinning nature and division nature, it is desirable that it is two-component system fiber. When using this polyamide (a) as one component, the fiber for which the polyamide (a) is divided especially into the field of 8-200 two or more with other thermoplastic polymers on the fiber cross section is desirable. Moreover, the fiber for which the polyamide (a) is following the direction substantially in fiber length is desirable. More specifically, bicomponent fibers, such as a multilayer-like assembled die and a radial assembled die, as shown in (1) - (6) of drawing 1 can use it suitably.

[0018] As for the fineness (fiber fineness after division when divided) of the fiber (A) which constitutes a separator, it is desirable that it is 0.005 - 0.5dtex from the point of lamellation, formation, and separate nature. Moreover, as for the fiber cross section, it is desirable that whenever [cross-section / which is expressed with the ratio (DI/Ds) of a major axis and a minor axis / flat] are 2.0-50.0. It is 2.0-25.0 more preferably and the thing of 2.2-15.0 is used suitably still more preferably. When fineness is less than 0.005 dtexes, sheet-ization may become difficult and the endurance of a separator may fall remarkably. Moreover, when exceeding 0.5dtex, and lamellation of the separator is carried out, formation gets worse remarkably. Even if it is a sheet 100 micrometers or less by making the fiber in a textile into this fineness and a flattened section configuration, formation can be equalized, while pore size becomes small and being able to improve separate nature further. Moreover, although especially fiber length is not limited and it can set up suitably by the formation approach of a separator, in order to obtain a thin and uniform nonwoven fabric, it is desirable to form a nonwoven fabric by the wet milling-paper method, and it is desirable that it is 1-30mm in this case. About a fiber cross section, when whenever [cross-section / which is expressed with the ratio (DI/Ds) of a major axis and a minor axis / flat] is less than 2.0, aggravation of the formation of the sheet by the lamellation of a separator becomes large, and it is hard to demonstrate the description. Moreover, when whenever [cross-section flat] exceeds 50, it may be difficult to obtain the fiber of a stable cross-section configuration. In addition, in this invention, in the case of the multilayer mold assembled-die bicomponent fiber of drawing 1 as shown in (1), as the major axis D1 of a flat fiber cross section and a minor axis Ds are shown in drawing 2 , they ask it.

[0019] Especially as other thermoplastic polymers, although not limited, since an assembled-die bicomponent fiber is ******-ized with mechanical stress, such as shearing force, polyester

system resin, olefin system resin, polyphenylene sulfide, etc. can be used suitably. When these resin is used, since compatibility with a polyamide (a) is scarce, fiber excellent in division nature is obtained. In this case, the fiber substantially divided completely by the disaggregation force by the pulper and mixer at the time of wet paper milling is obtained. For this reason, it is not necessary to perform high-pressure stream interlacement for ******-izing, the pinhole by stream interlaced marks is not generated, and since the fiber which carried out full division substantially can be milled, there is an advantage that the sheet of uniform formation is obtained compared with the wet sheet with which fiber was ******-ized by processing after paper milling of pressurization etc. The separator excellent in electrolytic-solution-proof nature and thermal resistance is obtained by using the resin of polyethylene terephthalate, aromatic polyester, the poly methyl pentene, and polyphenylene sulfide especially.

[0020] Moreover, in this invention, other fiber may be blended in addition to a polyamide fiber (A), and a separator may be obtained. For example, polyethylene terephthalate, polybutylene terephthalate, Polyester systems, such as all aromatic polyester, polyphenylene sulfide, Aliphatic series polyamides, such as nylon 6 and Nylon 66; An ethylene-vinyl alcohol system copolymer, Polypropylene, polyethylene, polybutene, the poly methyl pentene, The cellulosic fiber which mercerized the fiber; natural cellulose fiber of the compound gestalt which consists of polyolefine system resin independent, such as ethylene propylene rubber and an ethylene-butene copolymer, or two kinds or more; The pulp by which marcerization was carried out, The fiber which consists of a polyamide (a) from which fineness differs can be mentioned. Moreover, it is also possible by using a well-known thermofusion nature binder especially binder fiber, a sizing agent, etc. to raise the gestalt stability of a nonwoven fabric. As for the single fiber fineness of these fiber, it is desirable that it is 0.01 - 3dtex from points, such as lamellation, formation, separate nature, and strength, and it is desirable from electrolytic-solution-proof nature and a heat-resistant point to blend the independent fiber of a polyester system, a polyolefin fiber, polyphenylene sulfide, or a polyamide (a). Especially the fiber cross section is not limited [mold / a round shape, a cocoon type, a hollow mold, / T]. In order to raise separator powerful, gestalt stability, etc. furthermore, a binder, especially binder fiber may be blended further. The above-mentioned effectiveness is acquired without raising internal resistance beyond the need, when a fibrous binder is blended. As for the fineness of binder fiber, from points, such as separator strength, homogeneity, and production process nature, it is desirable that it is 0.5 - 6dtex extent. In addition, after nonwoven-fabric-izing a fibrous binder, it is not necessary to hold the configuration of fiber clearly, and the above-mentioned effectiveness is acquired by manufacturing a nonwoven fabric using a fibrous binder.

[0021] Although binder fiber may be constituted by the single component, since sufficient strength can be held while doing the adhesion effectiveness so, being constituted by two or more components is desirable. Bicomponent fibers and sea island fiber, such as a sheath-core mold, side-by-side mold, stratified assembled-die, and radial assembled die, can use it suitably. Especially the fiber cross section is not limited [mold / a round shape, flat, a cocoon type, a hollow mold, / T].

[0022] Thus, remarkable effectiveness is acquired in respect of electrolytic-solution-proof nature, thermal resistance, etc. by fibrosing and using the polyamide (a) obtained as a member for separators. On the occasion of manufacture of the separator for capacitors, it can be made sheets, such as woven knitted goods, a dry type nonwoven fabric, and a wet nonwoven fabric, that what is necessary is just to sheet-ize using this fiber. Moreover, it is also possible to sheet-ize immediately after fibrosis by the melt BURON method or the span bond method. Especially sheet-izing by wet paper milling from the point that a sheet thin and uniform [desirable / that it is a nonwoven fabric / and] is obtained from points, such as separate nature and mechanical engine performance, is desirable. For the manifestation of improvement in surface smooth nature, thickness adjustment of a sheet, reinforcement, and densification, it is desirable after sheet-izing to perform heat calender processing.

[0023] The separator of this invention can also obtain the separator of internal resistance low with a thin shape, and uniform formation by using the polyamide fiber (A) of a flattened section configuration as a member for separators. Specifically, it is possible to set thickness to 100

micrometers or less. Int[redacted] resistance can be lowered by using [redacted]hin separator using the polyamide fiber (A) of this invention. When the mechanical strength as a nonwoven fabric is taken into consideration, 50 micrometers or more are desirable, and in order to thin-shape-ize and to raise the energy density of a capacitor, it is desirable that it is 100 micrometers or less. As for a basis weight, it is desirable that they are about two 20 - 60 g/m, and a consistency 0.1 - about three 0.6 g/cm.

[0024] It can consider as the separator for capacitors by processing the configuration of requests, such as a bag-like object and a spiral object, using this sheet for separators for capacitors as it is. Of course, the separator for capacitors may be manufactured combining things other than this sheet. For example, a laminating can be carried out to other sheets (a nonwoven fabric, film, etc.), or it can join together. However, from the point of acquiring the effectiveness of this invention efficiently, it is desirable to manufacture the separator for capacitors only from the above-mentioned sheet, especially a nonwoven fabric substantially. The capacitor excellent in many engine performance is obtained by incorporating the separator for capacitors of this invention.

[0025] Such a separator for capacitors can be used not only for the separator for capacitors but for a battery separator, a filter, a wiper, a packing material, etc.

[Translation done.]

EXAMPLE

[Example] Although an example explains this invention below, it is not limited at all by this example. In addition, each measured value in an example is a value measured by the following approaches.
[Thickness (mm)] JIS P It measured according to 8118 "the thickness of paper and the paper board, and the test method of a consistency."
[Basis weight (g/m2)] JIS P It measured according to 8124 "the meter basis-weight measuring method of paper."
[Reinforcement (kg / 15mm)] JIS P It measured according to 8113 "the tensile strength test method of paper and the paper board."
[Permeability (cm3/cm2/sec)] JIS L According to the permeability measuring method of 1096-1996 "a common textiles test method", it measured with the incorporated company Oriental energy machine factory Flagyl mold permeability test machine.
[electrolytic-solution-proof nature (%)] JIS P 8113 -- applying correspondingly -- the test piece before and behind electrolytic-solution-proof nature processing -- being powerful (N/15mm) -- it measured and expressed with the powerful retention. Processing carried out immersion processing of the test piece of a nonwoven fabric under nitrogen-gas-atmosphere mind for 1 hour at the 50-degree C polycarbonate (Wako Pure Chem, Inc. make).
While a thermogravimetric measurement machine (physical science: TAS-200) investigates the weight percentage reduction (%) of the separator held at 150 degrees C and 200 degrees C in the [heat-resistant (%)] nitrogen air current for 1 hour, it is visual observation about gestalt change.
[0027] [The example 1 of reference]
19.5 mols of [manufacture of polyamide (a) which uses 1 and 9-nonane diamine, and 2-methyl -1 and 8-octane diamine as diamine component, and uses terephthalic acid as dicarboxylic acid component] terephthalic acids, 1, 10.0 mols of 9-nonane diamines, the 2-methyl -1, 10.0 mols of 8-octane diamines, 1.0 mols of benzoic acids, 0.06 mols of sodium hypophosphite-hydrates, and 2.2l. of distilled water were added to the autoclave of 20l. of content volume, and the nitrogen purge be performed Subsequently, it stirred for 30 minutes at 100 degrees C, and the temperature up of the inside ** was carried out to 210 degrees C over 2 hours. At this time, the pressure up of the autoclave was carried out to 2.2MPa(s). After continuing a reaction then for 1 hour, the temperature up was carried out to 230 degrees C, and it kept at 230 degrees C after that for 2 hours, and the reaction was continued, having extracted the steam gradually and holding a pressure to 2.2MPa(s). Next, the prepolymer was obtained for the reaction continuously [the pressure was lowered to 1.0MPa(s) over 30 minutes, and / for further 1 hour]. Under 100 degrees C and reduced pressure, it dried for 12 hours and this prepolymer was ground to the magnitude of 2mm or less. The polymer was obtained by carrying out solid state polymerization of this grinding object under 230 degrees C and 10Pa for 10 hours. The limiting viscosity of the obtained polymer was 0.9 dl/g.
[0028] Melting extrusion of the polyamide (a) manufactured in the example 1 of [example 1] reference was carried out using the extruder, from the nozzle with a bore diameter of 0.15mm, it rolled round by part for 1,000m/in discharge and winding rate, and non-extended yarn was

obtained. Subsequently, [redacted]-extended yarn was extended using t[redacted]ater bath with a water bath temperature of 90 degrees C, and the tow of fineness 1.5dtex was obtained. The obtained tow was cut to 5mm of cut length, and it considered as the shortcut of (Polyamide a) independent fiber. Paper making of this shortcut was carried out with the hand papermaking paper machine (square shape 25cmx25cm), the wet nonwoven fabric of basis-weight about 40 g/m2 was created, subsequently the heat press was carried out in the embossing calender (embossing roll temperature of 240 degrees C, linear pressure 40 kg/cm), and the separator for capacitors was obtained. The obtained separator had homogeneity and electrolytic-solution-proof nature, thermal resistance, and a high mechanical property, and it was what has the engine performance which was excellent as a separator for capacitors. The engine performance is shown in Table 1.

[0029] The polyamide (a) obtained in the example 1 of [example 2] reference 67 mass % (X zone), The polyethylene terephthalate of intrinsic viscosity 0.68 (it measures at 30 degrees C with the of-the-same-quality amount mixed solvent of a phenol/tetrachloroethane) is compounded with the compounding ratio of 33 mass %. Melting extrusion was carried out with the extruder and Y layers of X zone as shown in (1) of discharge and drawing 1 from the round hole nozzle of 0.25mmphi manufactured the elliptical multilayer mold assembled-die bicomponent fiber which comes to carry out a laminating by turns. X zone is [six layers and Y layers of the number of the layers of this assembled-die bicomponent fiber] a total of 11 five-layer layers. Subsequently, it extended using the water bath with a water bath temperature of 90 degrees C, and the tow of fineness 3.0dtex was obtained. The obtained tow was cut to 5mm of cut length, and it was made the shortcut of the assembled-die bicomponent fiber which consists of a polyamide (a) and polyester. The cross-section oblateness (DI/Ds) after division of an assembled-die bicomponent fiber was 2.4-7.5. Moreover, the polyethylene terephthalate of intrinsic viscosity 0.55 was fibrosed like the example 1, non-extended yarn was obtained, and it was made the shortcut of 5mm cut. Paper making of shortcut 70 mass [of the assembled-die bicomponent fiber which consists of this polyamide (a) and polyester] %, and the shortcut 30 mass % which consists of non-extended yarn of polyester was carried out with the hand papermaking paper machine (square shape 25cmx25cm), the basis weight of about 40g/the wet nonwoven fabric of m2 was created, subsequently the heat press was carried out in the calender (roll temperature of 230 degrees C, linear pressure 40 kg/cm), and the separator for capacitors was obtained. The obtained separator had homogeneity and electrolytic-solution-proof nature, thermal resistance, and a high mechanical property, and it was what has the engine performance which was excellent as a separator for capacitors. The engine performance is shown in Table 1.

[0030] The shortcut of an assembled-die bicomponent fiber was obtained like the example 2 except having used the poly methyl pentene (Mitsui Chemicals, DX820) instead of the polyethylene terephthalate of [example 3] intrinsic viscosity 0.68. Moreover, the shortcut of the non-extended yarn of a polyamide (a) was obtained like the example 2 except having used the polyamide (a) of intrinsic viscosity 0.65 instead of the polyethylene terephthalate of intrinsic viscosity 0.55. Paper making of these was carried out like the example 2, calender processing was carried out and the separator was obtained. The obtained separator had homogeneity and electrolytic-solution-proof nature, thermal resistance, and a high mechanical property, and it was what has the engine performance which was excellent as a separator for capacitors. The engine performance is shown in Table 1.

[0031] The separator was obtained like the example 3 except using polyphenylene sulfide (Toray Industries, Inc.: FO TRON E2481) instead of using a [example 4] poly methyl pentene. The obtained separator had homogeneity and electrolytic-solution-proof nature, thermal resistance, and a high mechanical property, and it was what has the engine performance which was excellent as a separator for capacitors. The engine performance is shown in Table 1.

[0032] The shortcut of an assembled-die bicomponent fiber was obtained like the example 3 except using polypropylene (Japan Polychem, SD2) instead of using a [example 5] poly methyl pentene. Paper making of shortcut 80 mass % of this assembled-die bicomponent fiber and the (Polyamide a) extension yarn shortcut 20 mass % of an example 1 was carried out like the example 3, calender processing was carried out at 170 degrees C, and the separator was obtained. It was that in which the polypropylene component of an assembled-die bicomponent

fiber serves as a binder, the obtained separator has the engine performance which homogeneity and electrolytic-solution-proof nature, thermal resistance (however, polypropylene fused and the gestalt was changing a lot at 200 degrees C), and whose mechanical property were high, and was excellent as a separator for capacitors. The engine performance is shown in Table 1.

[0033] In the [example 1 of comparison] example 1, fibrosis and the separator which carries out paper making, carries out embossing processing at 100 degrees C, and consists of polyethylene were obtained like the example 1 instead of the polyamide (a) except having used polyethylene (Japan Polychem, HE483). Although the obtained separator was excellent in homogeneity and electrolytic-solution-proof nature, thermal resistance (at 150 degrees C, polyethylene fuses and a gestalt changes a lot) and a mechanical property were low. The engine performance is shown in Table 1.

[0034]

[Table 1]

	厚さ μm	坪量 g/m²	強度 N/15mm	透気度 cm³/cm²/sec	耐電解液性 %	耐熱性 150℃ %	耐熱性 200℃ %
実施例1	136	40.1	18.6	4.9	99	0.1	0.1
実施例2	98	40.2	27.9	3.8	99	0.1	0.1
実施例3	92	39.9	28.3	3.6	99	0.1	0.1
実施例4	96	40.1	29.5	3.7	99	0.1	0.1
実施例5	89	39.8	30.1	3.1	99	0.2	—
比較例1	122	38.9	11.3	4.6	99	—	—

[Translation done.]

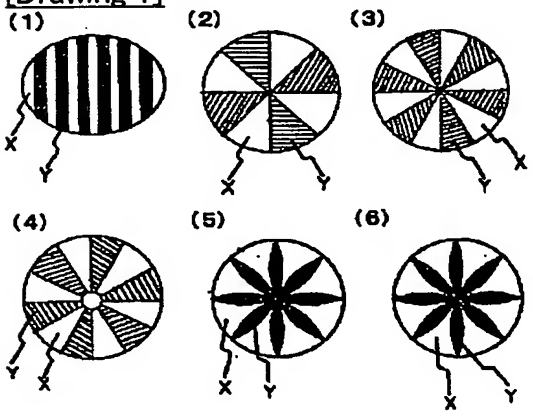
DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] It is the cross-section enlarged drawing of an example of an assembled-die bicomponent fiber applicable to this invention.
[Drawing 2] It is drawing for explaining the major axis of a polyamide fiber (A), and a minor axis.
[Description of Notations]
X: Polyamide (a)
Y: Other thermoplastic polymers
DI: Major axis
Ds: Minor axis

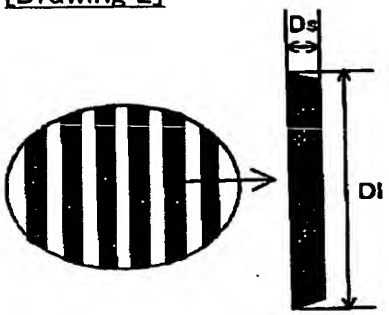
[Translation done.]

DRAWINGS

[Drawing 1]



[Drawing 2]



[Translation done.]